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EXAMINER

PEREZ, GUILLERMO

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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Paper No. 19

Application Number: 09/371,692
Filing Date: August 10, 1999
Appellant(s): KALSI, SWARN S.

Faustino A. Lichauco
For Appellant

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EXAMINER'S ANSWER

This is in response to the appeal brief filed October 16, 2002.

(1) ***Real Party in Interest***

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

(4) *Status of Amendments After Final*

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct.

(6) *Issues*

The appellant's statement of the issues in the brief is correct.

(7) *Grouping of Claims*

The rejection of claims 1-22 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

(8) *Claims Appealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) *Prior Art of Record*

5,325,002	RABINOWITZ ET AL.	6-1994
4,885,494	HIGASHI	12-1989

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4,176,291	RABINOWITZ	11-1979
3,904,901	RENARD ET AL.	3,904,901
5,602,430	KALSI ET AL.	2-1997

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 to 4, 9, 12 to 14, 16 and 21 to 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rabinowitz et al. (U. S. Pat. No. 5, 325, 002) in view of Higashi (U. S. Pat. No. 4,885,494).

Rabinowitz et al. ('002) disclose a superconducting electric motor (figure 6) comprising:

a rotor assembly (61, 62, 63, 64) including:

at least one superconducting winding (62, 63 and column 5, lines 66-68 and column 6, lines 1-3) which, in operation, generates a flux path within the rotor assembly (61, 62, 63, 64). Rabinowitz et al. ('002) disclose a support member (61) which supports the at least one superconducting winding (62,63), the rotor assembly (61, 62, 63, 64) configured to operate in a synchronous mode of operation at temperatures wherein the

superconducting winding (62,63) exhibits superconducting characteristics and in an induction mode of operation at temperatures wherein the superconducting winding (62, 63) exhibits non-superconducting characteristics (column 6, lines 60 to 64; column 9, lines 4 to 15 and 33 to 38).

Rabinowitz et al. ('002) disclose that the rotor assembly (61, 62, 63, 64) includes induction structure configured to allow the superconducting motor to generate a starting torque which is at least 50% of the rated torque in the induction mode of operation (column 9, lines 4 to 32). Rabinowitz et al. ('002) disclose that the rotor assembly (61, 62, 63, 64) includes induction structure configured to allow the superconducting motor to generate a peak torque which is approximately twice the rated torque in the induction mode of operation (column 9, lines 4 to 32).

Rabinowitz et al. ('002) disclose that the induction structure includes the support member (61) which supports the at least one superconducting winding (62,63). Rabinowitz et al. ('002) disclose a stator assembly (60) electromagnetically coupled to the rotor assembly (61, 62, 63, 64).

Rabinowitz et al. ('002) disclose an adjustable speed drive providing an electrical signal to the stator assembly (60) (column 9, lines 4 to 32). Rabinowitz et al. ('002) disclose that the adjustable speed drive provides a signal at a first frequency to the stator (60) to start the superconducting motor in the synchronous mode of operation and provides a signal at a second frequency, less than the first frequency, to the stator (60) in the induction mode of operation (column 9, lines 4 to 32).

Rabinowitz et al. ('002) disclose that the superconducting winding (62,63) includes a high temperature superconductor (see Table 2) and that the support member (61) is formed of aluminum.

Rabinowitz et al. ('002) disclose a method of operating a superconducting electric motor of the type including a rotor assembly (61, 62, 63, 64) including at least one superconducting winding (62,63) which, in operation, generates a flux within the rotor assembly (61, 62, 63, 64), and a support member (61) which supports the at least one superconducting winding (62,63). Rabinowitz et al. ('002) disclose that the method comprises:

- monitoring the temperature of the superconducting winding (62,63)
- operating the superconducting motor in a synchronous mode at a temperature wherein the superconducting winding exhibits superconducting characteristics
- operating the superconducting motor in an induction mode at a temperature wherein the superconducting winding exhibits non-superconducting characteristics (column 9, lines 4 to 32).

Rabinowitz et al. ('002) disclose that operating the superconducting motor in the synchronous mode includes providing an electrical signal to a stator assembly (60), electromagnetically coupled to the rotor assembly (61, 62, 63, 64), the signal having a first frequency. Rabinowitz et al. ('002) disclose that operating the superconducting motor in the induction mode includes providing a signal to the stator assembly (60) at a second frequency, less than the first frequency (column 9, lines 4 to 32).

However, Rabinowitz et al. ('002) do not disclose that the rotor assembly includes induction structure for carrying current at levels sufficient to allow the steady-state induction mode of operation.

Higashi discloses that the rotor assembly (figure 5) includes induction structure for carrying current at levels sufficient to allow the steady-state induction mode of operation (column 4, lines 38-61). Higashi's invention has the purpose of improving efficiency of the electric motor at start-up and operation.

It would have been obvious at the time the invention was made to modify the superconducting electric motor of Rabinowitz et al. ('002) and provide it with the rotor assembly disclosed by Higashi for the purpose of improving efficiency of the electric motor at start-up and operation.

Claims 5 to 8, 10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rabinowitz et al. ('002) in view of Higashi as applied to claims 1, 4 and 9 above, and further in view of Rabinowitz (U. S. Pat. No. 4, 176, 291).

Rabinowitz et al. ('002) and Higashi disclose a superconducting electric motor as described on item 1 above. However, neither Rabinowitz et al. ('002) nor Higashi disclose that at least a portion of the induction structure is spaced from the at least one superconducting winding by a thermal isolation vacuum region. Neither Rabinowitz et al. ('002) nor Higashi disclose that the at least portion of the induction structure spaced from the at least one superconducting winding by a thermal isolation vacuum region includes an electromagnetic shield member. Neither Rabinowitz et al. ('002) nor Higashi disclose a cryostat positioned between the thermal isolation vacuum region and the

induction structure. Neither Rabinowitz et al. ('002) nor Higashi disclose that the electromagnetic shield member includes a conductive, non-magnetic material. Neither Rabinowitz et al. ('002) nor Higashi disclose that the induction structure further includes an electromagnetic shield spaced from the at least one superconducting winding by a thermal isolation vacuum region. Neither Rabinowitz et al. ('002) nor Higashi disclose that the superconducting winding is a racetrack shaped winding.

Rabinowitz ('291) discloses that at least a portion of the induction structure (18) is spaced from the at least one superconducting winding (44) by a thermal isolation vacuum region (19). Rabinowitz ('291) discloses that the at least portion of the induction structure (18) spaced from the at least one superconducting winding (44) by a thermal isolation vacuum region (19) includes an electromagnetic shield member (18). Rabinowitz ('291) discloses a cryostat (58, 59, 60) positioned between the thermal isolation vacuum region (19) and the induction structure (18).

Rabinowitz ('291) discloses that the electromagnetic shield member (18) includes a conductive, non-magnetic material. Rabinowitz ('291) discloses that the superconducting winding (44) is a racetrack shaped winding. Rabinowitz's invention have the purpose of screening the superconducting winding from non-synchronous components of the magnetic fields produced by unbalanced or transient currents in the armature winding and absorb thermal radiation from the ambient temperature and re-radiating it at a lower temperature.

It would have been obvious at the time the invention was made to modify the superconducting electric motor of Rabinowitz et al. ('002) and Higashi and provide it

with the induction structure, the thermal isolation vacuum region, the electromagnetic shield member, the cryostat, and the superconducting winding disclosed by Rabinowitz ('291) for the purpose of screening the superconducting winding from non-synchronous components of the magnetic fields produced by unbalanced or transient currents in the armature winding and absorb thermal radiation from the ambient temperature and re-radiating it at a lower temperature.

Claims 17 to 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rabinowitz et al. ('002) in view of Higashi and further in view of Renard et al. (U. S. Pat. No. 3, 904, 901).

Rabinowitz et al. ('002) and Higashi disclose a superconducting electric motor as described on item 1 above and also that the superconducting winding, in operation, generates flux within the rotor assembly Rabinowitz et al. ('002) and Higashi disclose an electromagnetic shield surrounding the cryostat and the at least one superconducting winding. However, neither Rabinowitz et al. ('002) nor Higashi disclose a cryostat surrounding the rotor assembly.

Renard et al. disclose a cryostat (119, 120) surrounding the rotor for the purpose of maintaining the at least one superconducting winding at cryogenic temperatures.

It would have been obvious at the time the invention was made to modify the superconducting electric motor of Rabinowitz et al. ('002) and Higashi and provide it with a cryostat surrounding the rotor as disclosed by Renard et al., for the purpose of maintaining the at least one superconducting winding at cryogenic temperatures.

Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rabinowitz et al. ('002) in view of Higashi and of Rabinowitz ('291) as applied to claim 10 above, and further in view of Kalsi et al. (U. S. Pat. No. 5, 602, 430).

Rabinowitz et al. ('002), Higashi and Rabinowitz ('291) disclose a superconducting electric motor as described on item 2 above. However, neither Rabinowitz et al. ('002), Higashi nor Rabinowitz ('291) disclose that the support member includes a plurality of laminations, each lamination lying in a plane parallel to magnetic field flux lines extending through the laminations during operation of the superconducting electric motor.

Kalsi et al. disclose that the support member (3) includes a plurality of laminations, each lamination lying in a plane parallel to magnetic field flux lines (55) extending through the laminations during operation of the superconducting electric motor (figures 1 and 2) for the purpose of reducing the migration of stray magnetic flux out of the core poles.

It would have been obvious at the time the invention was made to modify the superconducting electric motor of Rabinowitz et al. ('002), Higashi and Rabinowitz ('291) and provide it with a support member including a plurality of laminations as disclose by Kalsi et al. for the purpose of reducing the migration of stray magnetic flux out of the core.

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rabinowitz et al. ('002) in view of Higashi and further of Renard et al. as applied to claim 17 above, and further in view of Kalsi et al. (U. S. Pat. No. 5, 602, 430).

Rabinowitz et al. ('002), Higashi and Renard et al. disclose a superconducting electric motor as described on item 3 above. However, neither Rabinowitz et al. ('002), Higashi nor Renard et al. disclose that the support member includes a plurality of laminations, each lamination lying in a plane parallel to magnetic field flux lines extending through the laminations during operation of the superconducting electric motor.

Kalsi et al. disclose that the support member (3) includes a plurality of laminations, each lamination lying in a plane parallel to magnetic field flux lines (55) extending through the laminations during operation of the superconducting electric motor for the purpose of reducing the migration of stray magnetic flux out of the core poles.

It would have been obvious at the time the invention was made to modify the superconducting electric motor of Rabinowitz et al. ('002), Higashi and Renard et al. and provide it with a support member including a plurality of laminations as disclose by Kalsi et al. for the purpose of reducing the migration of stray magnetic flux out of the core.

(11) Response to Argument

Rabinowitz does not teach away from a superconductor winding

Applicant's arguments are directed to point out that Rabinowitz teaches away from a superconducting winding. The Applicant also argues that Rabinowitz teaches away from a motor including more than one winding.

As explained below:

- Rabinowitz teaches a rotor which incorporates superconducting winding in non-wire form; and
- the limitations on which the Applicant relies (i.e., "*a motor that includes more than one winding*"; "*wire-shaped winding*") are not stated in the claims.

Rabinowitz discloses in column 5, lines 58-60 that "*this motor/generator has only a primary set of windings*", which is referring to the windings in the stator, but later defines that the rotor does not contain wire-shaped windings. It is clear that Rabinowitz provides a distinction between the terms "windings" and "wire-shaped winding". The first term is directed to "One complete turn of something wound: *two windings of electrical tape*". (*The American Heritage® Dictionary of the English Language, Third Edition* copyright © 1992 by Houghton Mifflin Company). The second phrase describes a specific type of winding: wound wire.

Rabinowitz discloses in column 5, lines 64-66 that the "*superconducting material can be in any of a variety of forms, including particulate, foil, bulk and thin film superconducting materials*." Rabinowitz later on column 5, line 66 through column 6, line 3 differentiates between the term "winding" and the term "wire-shaped winding" as follows: "*Because it is in a non-wire form, instead of one or more windings of wire, the motor/generator can be implemented with substantially any superconducting material, including those that are too brittle to be easily and/or cost-effectively formed as superconducting wires*." As seen from Rabinowitz and the definition of "windings" provided by the American Heritage Dictionary: an electrical tape (also foil, and thin film as disclosed by the Heritage dictionary and Rabinowitz) can be wound to form a

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winding. Rabinowitz discloses the claimed limitation: "*at least one superconducting winding*".

Rabinowitz discarded windings of wire in its embodiment, but not necessarily other types of windings like wound tape, thin film, or foil. As stated above, Rabinowitz discarded the windings of wire because some superconducting materials "*are too brittle to be easily and/or cost-effectively formed as superconducting wires*". Thus, in Rabinowitz, wires are undesirable while windings are desirable. Also in Rabinowitz, the secondary windings of wire are not desirable in the rotor, but the windings of wound tape, thin film, or foil are desirable.

Rabinowitz points out that some superconducting materials can be shaped as wires while other materials are difficult to be shaped as wires. Rabinowitz also acknowledges that the advantage of one superconducting material over another superconductive material lies on its cost. From that point of view, Rabinowitz eliminated wires from the embodiments, but not windings. Wires are not the only configuration used to form windings, tape, thin films, and foils are other configurations use to form motor windings. Rabinowitz discloses the use of tape, thin film, or foil configurations to form the rotor winding.

Claims 1-22 recite that the rotor includes "*at least one superconducting winding*", but the claims do not recite that *the motor includes more than one winding*, nor that *the winding is of the wire type*. The limitations on which the Applicant relies (i.e., "a motor that includes more than one winding", "windings of wire") are not stated in the claims. It is the claims that define the claimed invention, and it is claims, not specifications that

are anticipated or unpatentable. *Constant v. Advance Micro-devices Inc.*, 7 USPQ 2d 1064.

The proposed combination of Higashi and Rabinowitz does not change the principle of operation of Rabinowitz.

In response to Applicant's argument that transplanting the rotor assembly of Higashi in place of the rotor of Rabinowitz would change the principle of operation of Rabinowitz, it must be noted that the proposed modification consists of providing the rotor assembly of Rabinowitz with induction structure for carrying current at levels sufficient to allow the steady-state induction mode of operation and not of transplanting one rotor in place of the other.

The induction structure disclosed by Higashi includes a specific configuration of hollow bars 4 and grooved rings 5. The hollow portion and the grooves 11, 12 are filled with superconductive material 13. When the superconducting material is cooled to a specific critical temperature, the machine operates as a superconductive motor. When the superconductive material is at a specific higher temperature, the superconducting material loses its superconductivity and the electrically conductive bars 4 and rings 5 allow the machine to operate as an induction motor. Higashi discloses that these bars 4 and rings 5 form induction structure (see figure 6 and column 4, lines 30-35 and lines 41-45) for carrying current at levels sufficient to allow the steady-state induction mode of operation.

The bars 4 and rings 5 surround the superconductive material 13 in the rotor of Higashi. These bars 4 and rings 5 are inducing torque in the rotor (column 4, lines 41-

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45) and are shielding the superconducting material from the magnetic fields of the stator (figures 5-6 and column 3, line 57 through column 4, line 2), as is being done by Rabinowitz. Modifying the rotor disclosed in Rabinowitz with the induction structure disclosed in Higashi would not change the principle of operation of Rabinowitz. I will improve upon it.

Rabinowitz discloses the use of induction structure in the rotor enough to assure a startup of the machine. Providing the torque shield 14 does this. Providing an induction structure as disclosed in Higashi to the rotor of Rabinowitz would provide a current at levels sufficient to allow the steady-state induction mode of operation lacking in Rabinowitz.

In response to applicant's argument that Higashi would change the principle of operation of Rabinowitz, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

The proposed combination of Higashi and Rabinowitz teaches a superconductive winding

Applicant argues that short-circuiting the individual turns in the winding would undermine the winding's ability to support a magnetic field. However, Higashi in column 1, lines 10-16 discloses that in a "*conventional squirrel cage induction motor, a short-*

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circuit looped in itself is formed in a squirrel cage rotor comprising a plurality of bar conductor short-circuited by two circular conductors opposite to each other at both ends thereof and power-supplied by an electro-magnetic induction from a stator side to generate a torque".

The magnetic field of the stator induces an electric current flow in the loops of the rotor windings. The induced current flow induces a magnetic field within a loop of the rotor winding. The induced magnetic field in the rotor winding interacts with the magnetic field in the stator, thus generating the above-mentioned torque.

If the short-circuited loop winding used in squirrel-cage rotor type of motors as disclosed in Higashi undermine the winding's ability to support a magnetic field, then none of the nowadays-existing squirrel-cage type rotor induction motors would operate. Higashi is describing what is commonly known in the art as a widely used and operating induction type of motor.

Higashi discloses that the bars 4 and rings 5 form induction windings (see figure 6 and column 4, lines 30-35 and lines 41-45) for carrying current at levels sufficient to allow the steady-state induction mode of operation. In Higashi, each short-circuited loop (see figure 6) represents an individual turn through which a magnetic field is induced.

The Applicant argues that a winding is defined as a wound wire. As stated above, a winding is "One complete turn of something wound: *two windings of electrical tape*". (*The American Heritage® Dictionary of the English Language, Third Edition* copyright © 1992 by Houghton Mifflin Company).

Wires windings are one type of winding. Higashi forms the short-circuited looped windings with rings 5 attached to each other through bars 4 (see figures 5-6), which is a

further type of winding. As the prior art teaches, there are different types of configurations that can be used to form motor windings, other than wires alone.

Higashi and Rabinowitz teach the use of superconducting windings.

There is motivation to combine Higashi and Rabinowitz

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

In this case, both Higashi and Rabinowitz are directed to improving the startup characteristic of the motors. Higashi reaches this improvement by providing a combination of resistances in the windings of the rotor, which will avoid a large electric loss during constant-speed operation of the machine. This electric loss happens when the size of the rotor windings is increased to improve startup characteristic. The combination of resistances (superconducting material and non-superconducting material) in the rotor windings of Higashi allows a good startup characteristic as well as a highly efficient synchronous motor operation (column 2, lines 4-13 and lines 46-58).

Rabinowitz is addressing problems of startup torque, maximum torque capacity, and design simplicity (column 4, lines 11-14). Rabinowitz provide the torque-shield (14)

to provide a startup torque to the rotor, and after startup the superconducting material provides the synchronous operation of the motor.

Higashi provides a torque-shield 4 which not only will provide the startup torque needed, but also will be capable of maintaining a steady-state mode of operation, when the synchronous-mode of operation provided by the superconductive material is not active (column 4, lines 41-45 and line 49 through column 5, line 7). Higashi improves the embodiment of Rabinowitz.

The Examiner proposed modification consists in providing the rotor assembly of Rabinowitz with induction structure for carrying current at levels sufficient to allow the steady-state induction mode of operation and not of transplanting one rotor in place of the other.

The rationale provided above is also applicable to claims 17 and 21.

For the above reasons, it is believed that the rejections should be sustained.

For the above reasons, it is believed that the rejections should be sustained.

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Respectfully submitted,

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December 26, 2002

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